

CLAIMS

1. A hollow fiber membrane module comprising: a sheet-form hollow fiber membrane (1) including a hollow fiber membrane having a non-porous layer; and an anchoring member (2),

5 wherein an end of a side of a hollow fiber membrane opening of the sheet-form hollow fiber membrane (1) is fastened by the anchoring member (2) so that a plurality of sheet-form hollow fiber membranes (1) are substantially parallel to each other while leaving the end open, an end face of the anchoring member (2) on a side where the hollow fiber membranes are exposed is substantially rectangular, and an end face of the anchoring member (2) on a side where the hollow fiber membranes open is substantially circular.

10 2. A hollow fiber membrane module according to claim 1, wherein the anchoring member (2) comprises a rectangular parallelepiped section (3) of substantially rectangular parallelepiped shape on a side where the sheet-form hollow fiber membranes (1) are exposed, and a cylindrical section (4) of substantially cylindrical shape on a side where the sheet-form hollow fiber membranes (1) open.

15 20 3. A hollow fiber membrane module according to claim 2, wherein a relationship $0.2 \leq L/D \leq 1$ is satisfied, where D (mm) is a diameter of the cylindrical section (4) and L (mm) is a length of the cylindrical section (4).

25 4. A hollow fiber membrane module according to claim 3, wherein D is 30 to 400 mm.

5. A hollow fiber membrane module according to claim 3, wherein L is 10 to 300 mm.

30 6. A hollow fiber membrane module according to claim 2, wherein a relationship $1 \leq W/D \leq 2$ is satisfied, where W (mm) is a length of a longer side of an end face of the rectangular parallelepiped section (3) where the sheet-form hollow fiber membranes (1) are exposed and D (mm) is a diameter of the cylindrical section (4).

7. A hollow fiber membrane module according to claim 6, wherein W is 40 to 500 mm.

5 8. A hollow fiber membrane module according to claim 1, wherein the hollow fiber membrane having a non-porous layer has a gas permeability of 0.01 to 50 $\text{m}^3/\text{m}^2 \cdot \text{MPa}$.

10 9. A hollow fiber membrane module according to claim 1, wherein the hollow fiber membrane having a non-porous layer is a three-layer composite hollow fiber membrane containing a three-layer structure in which porous layers are provided at both faces of the non-porous layer.

15 10. A hollow fiber membrane module according to claim 9, wherein the non-porous layer includes a gas-permeable material.

11. A hollow fiber membrane module according to claim 9, wherein the non-porous layer has a thickness of 0.3 to 3 μm and the porous layer has a thickness of 5 to 100 μm .

20 12. A hollow fiber membrane module according to claim 9, wherein the three-layer composite hollow fiber membrane has a ratio of a membrane thickness to an inner diameter (membrane thickness / inner diameter) of 0.1 or more.

13. A hollow fiber membrane module according to claim 9, wherein the three-layer composite hollow fiber membrane has an outer diameter of 100 to 3000 μm .

25 14. A hollow fiber membrane module according to claim 9, wherein the porous layer has a pore diameter of 0.005 to 1 μm .

30 15. A hollow fiber membrane module according to claim 9, wherein the porous layer includes polyolefin-based polymer.

16. A hollow fiber membrane module unit comprising:
a plurality of hollow fiber membrane modules each comprising:

a sheet-form hollow fiber membrane (1) including a hollow fiber membrane having a non-porous layer; and

an anchoring member (2),

wherein an end of a side of a hollow fiber membrane opening of the sheet-form hollow fiber membrane (1) is fastened by the anchoring member (2) so that a plurality of sheet-form hollow fiber membranes (1) are substantially parallel to each other while leaving the end open, an end face of the anchoring member (2) on a side where the hollow fiber membranes are exposed is substantially rectangular, and an end face of the anchoring member (2) on a side where the hollow fiber membranes open is substantially circular, and

wherein a plate member (5) having a hole through which at least a part of an anchoring member (2) passes is provided on a side surface of the hollow fiber membrane modules perpendicular to sheet surfaces of sheet-form hollow fiber membranes (1), and the plate member (5) is fastened between the anchoring member (2) and a water collecting cap (6).

17. A hollow fiber membrane module unit according to claim 16, wherein a plurality of hollow fiber membrane module units are stacked in a vertical direction, sheet surfaces of the sheet-form hollow fiber membranes (1) are disposed in a vertical direction, water collecting caps (6) that adjoin each other in a vertical direction are connected to each other by a water collecting member (7) that extends in a vertical direction, and a side plate (12) is disposed on a side face parallel to the sheet surfaces of the sheet-form hollow fiber membranes (1).

25 18 A water treatment method comprising the steps of: attaching microorganisms to exterior surfaces of sheet-form hollow fiber membranes (1); supplying water to be treated to the exterior surfaces; and supplying a gas into hollow portions of the sheet-form hollow fiber membranes (1) to purify the water to be treated,

wherein a hollow fiber membrane module comprises: the sheet-form hollow fiber membrane (1) including a hollow fiber membrane having a non-porous layer; and an anchoring member (2), wherein an end of a side of a hollow fiber membrane opening of the sheet-form hollow fiber membrane (1) is fastened by the anchoring member (2) so that a plurality of the sheet-form hollow fiber membranes (1) are substantially parallel to

each other while leaving the end open, an end face of the anchoring member (2) on a side where the hollow fiber membranes are exposed is substantially rectangular, and an end face of the anchoring member (2) on a side where the hollow fiber membranes open is substantially circular, or a hollow fiber membrane module unit in which a plurality of the
5 hollow fiber membrane modules are provided is used.

19 A water treatment method according to claim 18, further comprising discharging condensed water in the hollow portions of the hollow fiber membrane to the outside of the hollow portions using pressurized gas.